

SCADA systems for measuring and managing water

SCADA is the acronym for **Supervisory Control and Data Acquisition** systems. SCADA is electronic and capable of automation from the basic level to a very high level of sophistication. SCADA systems can be used on both pressurized systems and open channel (canal) systems.

The basic level is collection of data on the instantaneous quantity of water being diverted or withdrawn (Q_i) and the total quantity of water diverted or withdrawn (Q_a) at any point in time that a system is in operation. SCADA can be expanded with the addition of sensors to the system that collect data on equipment such as pressure at a pump, height of control gates, temperature of air and water, soil moisture, just about anything a user might want to know about the system. And, with telemetry, data can be accessed at any time (see Telemetry, below). SCADA can also be setup to start and stop a system, for example, when the right amount of water has been applied to a crop and no more water is needed until the soil water is depleted by the crop to the point where another irrigation is needed.

A water user can gradually work SCADA into a water delivery system if the user chooses not install a complete SCADA system up front. For pressurized systems, the basic startup is with electronic readout on the meter for Q_i and Q_a , a data-logger, and either a PDA or laptop computer. For canals, the basic startup is with a pressure transducer and a data-logger. The data-logger is connected to the electronic readout on pressurized systems, and to the pressure transducer on canal systems. Basic data for water users to collect is the Q_i and Q_a . The timing of data collection by the data-logger is determined by the user and at whatever intervals the user wants. For water users, the minimum interval for collecting data would be once weekly, although most users find that collecting at more frequent intervals proves to be a valuable aid to management of water and to control costs of diverting and delivering water to the system, among other uses.

Data stored in the data-logger must be downloaded periodically, depending on how often data is collected by the data-logger and the capacity of the data-logger for storing data. The user can download the data to a handheld PDA (personal digital assistant, also known as a handheld computer) or a laptop computer. Data is downloaded to the PDA or laptop computer, and then downloaded to a desktop computer. PDAs are becoming more popular because of ease of use and portability.

Advantages of SCADA to the user

There are a number of advantages of SCADA for users. A few are:

- Water users do not have to manually read and record meter readings at regular intervals because data on water use is collected automatically;
- Data can be downloaded at the users convenience;
- Can be rigged for telemetry access by radio, satellite, cell phone, or telephone landline and allow the user to remotely control the irrigation system and access data instantly.

Transponders and data-loggers

Transponders (Figure 1) are most often used in open channel systems. Transponders measure the volume of water diverted by relating the pressure of water above the transponder to the rating curve developed for the diversion. The deeper the water, the higher the pressure, which means that more water is being diverted, and vice versa. A rating curve is needed for open channel systems. The rating curve is correlated to the transponder readings. The readings then correspond to the amount of water being diverted. A data-logger (Figure 1) is wired to the transponder and periodically collects and stores data as specified by the user.

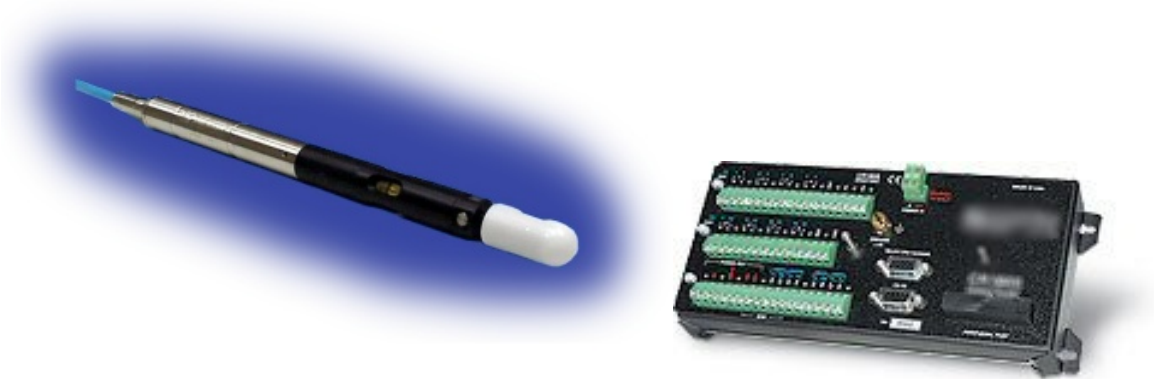


Figure 1. Typical transponder and data-logger. The transponder sends a periodic signal to the data-logger.

If a user wants to see the data when visiting the SCADA station, an electronic monitor display (Figure 2) should be included as part of the system. For pressurized systems that have an electronic reader, a data-logger is connected to the reader for collecting data.



Figure 2. Example of two styles of electronic flow monitors for use with SCADA

Telemetry

Users can expand the basic SCADA to satellite telemetry, radio telemetry, cell phone telemetry, or landline telemetry. Telemetry basically refers to accessing the data and controlling the system by remote means. With a telemetry setup, users can program the system to run automatically and let the user know the status of a system at any time. Users can access the system at any time and find out the status of the system at any time. If something goes wrong with the system, it can be set up to alarm the user.

SCADA on open channel systems (canals) can be programmed to automatically control the headgates to control the amount of water being diverted into the canal at any time. The headgate can be set up with motor drives so that the system can raise or lower the gates as necessary. Canal level control spills down-canal from the headgate can be integrated into the SCADA system to provide canal control throughout the length of the canal system, thereby allowing greater supervisory control of the system at any time.



Figure 3. Typical modem used to transmit data on water use to the user via a cell phone or land line.



Figure 4. What a SCADA system looks like on a stream or diversion



Figure 5. Typical installation set-ups for SCADA. These stations have telemetry for accessing the site to download data and to control the headworks.

Advantages of SCADA for both pressurized and open channel systems

In summary, SCADA offers the following advantages

- Instant control over canal and pressurized flows
- Accurate timing of water deliveries, precision in applying irrigation water

- Low capital investment for components
- Operation by commercial electric power, battery power, or solar power, or a combination of all three
- Easy to install and maintain
- Can increase the level of sophistication over time, allowing the user to expand at the convenience and comfort of the user.